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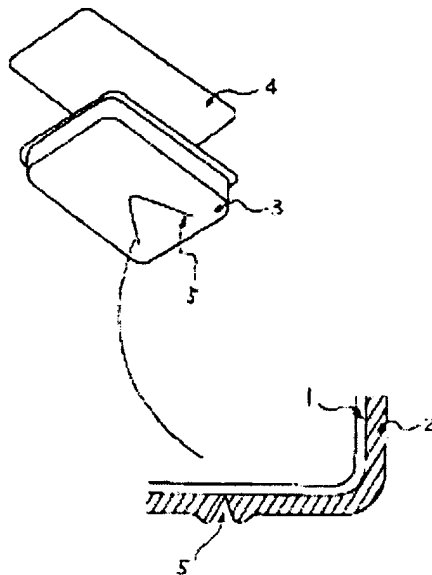
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(54) [Title of the Invention]: A Battery

(57) [Abstract]

[Objective] To decrease the operating pressure of the safety valve in comparison to conventional batteries and to make action safer during operation of the valve. To reduce variation in the operating pressure and to improve the reliability of the battery.

[Structure] A battery provided with a battery case obtained by laminating a resin film and molding a metal plate to which the film is adhered, A cut is established so as to penetrate through the metal plate of the battery case, The cut does not penetrate through the resin film.



[Claim]

[Claim 1] A battery characterized in that it is a battery provided with a battery case comprised of a metal plate on which a resin film is laminated and adhered, in that said battery case has a cut and in that said cut penetrates through the metal plate of said battery case but does not penetrate through said resin film. [Translators note: Claim has been changed in accordance with the Amendment. The underlined portion is added to the original claim as it appears on the first page.]

[Detailed Description of the Invention]

[0001]

[Field of industrial use]

This invention relates to a battery.

[0002]

[Prior art and problems thereof] Batteries of high energy density are superior [in performance]. However, when a battery has a high energy density and is used in an abnormal environment or incorrectly, the battery readily tends to rupture or explode, which is extremely dangerous.

[0003] Rubber reversible valves and rupturable safety valves using laminated aluminum foil can be used in conventional batteries. In this case, the operating pressure is lower and action during operation of the valve is safer the larger the bore diameter of the safety valve. However, when the bore diameter is increased, there are the drawbacks that water infiltrates from the outside through the rubber valve body and resin component of the laminated aluminum, that

electrolytic solution easily leaks to the outside and that long-term reliability of the battery is decreased in exchange for the improvement in safety.

[0004] Therefore, with the object of eliminating these drawbacks, a battery was proposed in which a cut that did not penetrate through the case was established in the metal case to create a rupture valve so that a tear develops in the case and pressure is released when internal pressure rises. However, because tearing of metal is used in this battery, there are the problems that the operating pressure of the battery is high and that there are great variations in operating pressure.

[0005]

[Means for solving the problems] This invention solves the aforementioned problems by using a battery characterized in that it is a battery that uses a battery case comprised of a metal plate on which a resin film is laminated and adhered, in that a cut is established in the aforementioned metal plate and in that said cut does not penetrate through the aforementioned resin film.

[0006]

[Action] The battery case of the battery of this invention has a double structure consisting of a metal layer and a resin layer. Thus, during ordinary use, sufficient mechanical strength is assured by the metal layer, and, at the time of an abnormality (when the internal pressure of the battery is elevated), the resin layer tears along the cut that is established in the metal layer and an opening is produced in the battery, with the internal pressure in the battery being released.

[0007] This cut may be established so that the entire cut penetrates through the metal layer or may also be established so that only a part of the cut penetrates through the metal layer. However, in order to maintain airtight sealing of the battery, the cut should not penetrate all the way through the resin.

Because the safety valve of the battery of this invention is caused to operate using tearing of resin, the operating pressure is lower and there is less variation than conventional safety valves using rupture of a metal plate.

[0008] Because the aforementioned resin is dispersed to the outside atmosphere only in that part of the cut that is established in a linear pattern, permeation of water and loss of electrolytic solution are less of a problem than with conventional valves using rubber valves and laminated aluminum foil. There is even less water permeation when the resin layer is constructed of low moisture-permeable polypropylene, polyethylene or polyethylene terephthalate.

[0009]

[Example]

We shall now present an example.

[0010] A lithium secondary battery of this invention was manufactured as follows.

[0011] The battery case was manufactured as follows. A steel plate 2 of 0.22 mm in thickness onto the inside face of which the 70 μ m PP film 1 was laminated and adhered and the outside face of which was coated with an 8 μ m film was press molded and the square battery case body 3 and the battery case cover 4 were made. At this time, the cut 5, which was V-shaped in cross section,

was established as shown in Figure 1 in the bottom face of the case body.

Although this cut penetrated through the metal plate, it did not penetrate through the resin layer. In the figure, the peripheral edges of the cut are extended. By making the cut in this way, a concentration of stress on the tip of the cut is facilitated and variations in operating pressure are decreased.

[0012] The sequence of manufacture of the battery case may be different from the sequence described above. For example, the cut may be made in the metal plate first, after which the resin film is adhered and after which press molding may be performed. Press molding may be performed after the cut has been made in the metal plate, after which the resin film may be adhered.

[0013] Next, a battery-power generating assembly comprised of a cathode plate and an anode plate was housed in the aforementioned battery case, the battery was sealed with a double wound seal, with the square lithium secondary battery (A) of this invention being manufactured.

[0014] The battery (A) of this invention, in addition to being square as in the aforementioned example, may also be cylindrical as shown in Figure 2. The position of the cut is not limited to the bottom face of the battery. The entire cut need not penetrate through the metal plate, with only some of it penetrating.

[0015] In order to prevent infiltration of water, a metal foil 6 may be affixed to a portion of the cut using the adhesive layer 7 as shown in Figure 3.

[0016] Next, a comparative battery (B) was manufactured in the same way as battery (A) of this invention except that a cut was made in the battery case that did not penetrate through the metal layer.

[0017] Twenty each of the aforementioned two types of batteries were manufactured, they were charged and a study was conducted of internal pressure during operation of the safety valve. Determination of internal pressure was performed by making a round hole of 2 mm in the battery case and connecting a manometer. As a result, the operating pressure of the battery of this invention was $7 \pm 0.5 \text{ Kg/cm}^2$, whereas the valve operating pressure of the comparative battery was high, at $18 \pm 0.5 \text{ Kg/cm}^2$, with great variation being seen.

[0018] Further, the comparative battery made a great deal of noise during operation of the valve and there was the danger that the contents would disperse. However, the battery of this invention made little noise during operation of the valve and the battery was very safe, there being no dispersing of the contents. An attempt was made to decrease the valve operating pressure to on the order of 7 to 10 Kg/cm^2 by making the cut in the comparative battery deeper. However, a crack developed in the tip of the cut and leakage of fluid was facilitated. This was not desirable.

[0019] In the example, a cut was made in one site of the battery canister. However, cuts may be established in several sites. Further, the type of battery is not limited to lithium secondary batteries and the invention may also be applied to other types of batteries such as nickel-cadmium batteries.

[0020]

[Effect of the invention] In the battery of this invention as described above, the operating pressure of the safety valve can be lower than that of conventional

batteries with the result that the action during valve operation is safer and safety is improved. Further, because there is little variation in operating pressure, the reliability of the battery is increased.

[Brief Explanation of the Figures]

[Figure 1] This is a diagram that shows the battery case body of this invention.

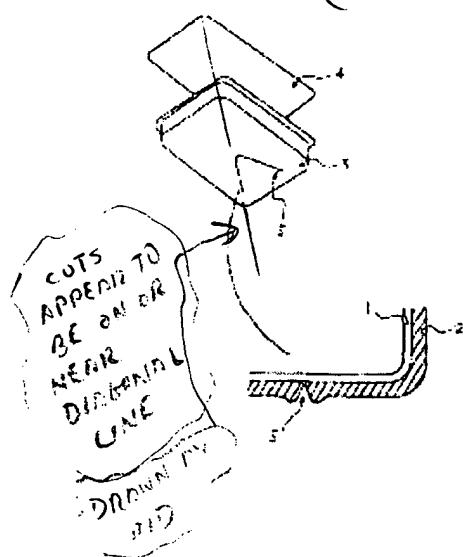
[Figure 2] This is a diagram that shows cylindrical lithium batteries of this invention.

[Figure 3] This is a diagram that shows a cut to which metal foil has been affixed.

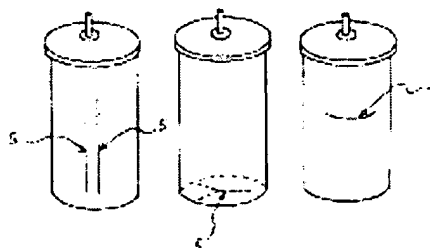
[Explanation of Symbols]

- 1 resin film
- 2 metal plate
- 5 cut

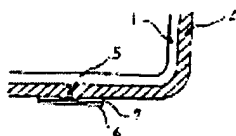
[Figure 1]



[Figure 2]



[Figure 3]



[Translator's NOTE: The Specification is followed by Amendments which have been incorporated in the translation.]



PATENT ABSTRACTS OF JAPAN

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H01M 2/02**H01M 2/12**(21) Application number: **06017028**(22) Date of filing: **17.01.94**(71) Applicant: **JAPAN STORAGE BATTERY CO LTD**(72) Inventor: **TSUKAMOTO HISASHI**(54) **BATTERY**

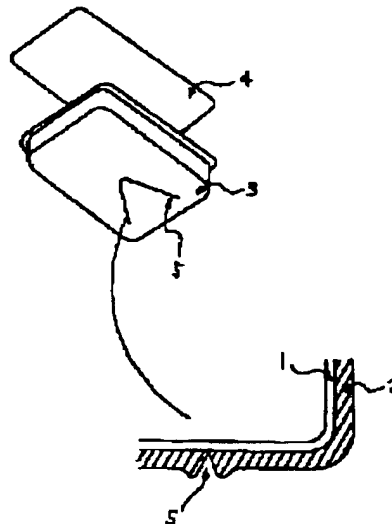
improve the reliability.

(57) Abstract

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PURPOSE: To improve safety at the time of operating a safety valve, and to reduce unevenness of the working pressure to improve reliability of a battery by providing a notch in a metal plate so that the notch does not pass through a resin film.

CONSTITUTION: A metal plate 2, of which inner surface is coated with a resin film 1 by laminating the film 1 for adhesion and of which outer surface is coated with a coating film, is pressed to form a rectangular battery case main body 3 and a battery case lid 4. In this case, a V-shape notch 5 is provided in the bottom surface of the main body 3. This notch 5 passes through the metal plate 2, but it does not pass through the resin film 1, and the peripheral part of the notch 5 is heaped. Concentration of the stress to the tip of the notch 5 is thereby easy to be generated to reduce the unevenness of the working pressure of a safety valve. Namely, since the working pressure of the safety valve can be reduced, the safety valve is thereby safely operated at the time of operation to improve the safety, and while since the unevenness of the working pressure is reduced to



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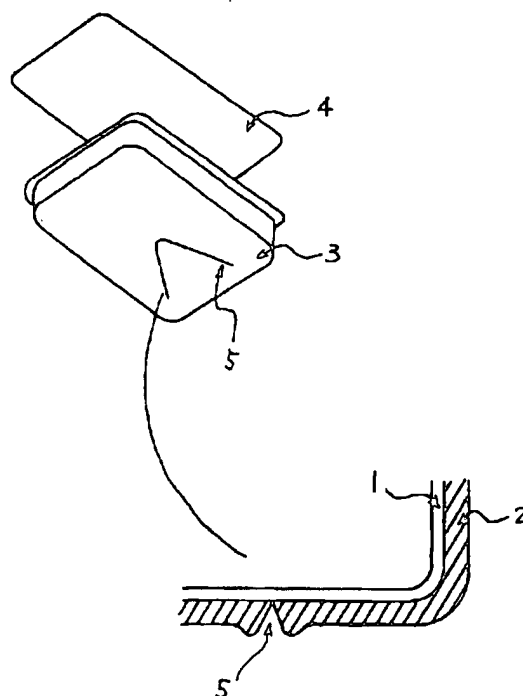
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(54) 【発明の名称】 電池

(57) 【要約】

【目的】従来の電池に比較して安全弁の作動圧を低くし、弁作動時の挙動をより安全にする。作動圧のバラツキを少なくし、電池の信頼性を向上させる。

【構成】樹脂フィルムを積層して接着した金属板を成形してなる電池ケースを備えた電池。電池ケースの金属板部を貫通するように切れ込みが設けられている。切れ込みは樹脂フィルムを貫通しない。



【特許請求の範囲】

【請求項1】金属板を成形してなる電池ケースを備えた電池において、
該電池ケースの内面には樹脂フィルム層を有し、
該電池ケースは切れ込み部を有し、
該切れ込み部は該電池ケースの金属板を貫通し、かつ該樹脂フィルムを貫通していないことを特徴とする電池。

【発明の詳細な説明】

【0001】

【産業上の利用分野】本発明は、電池に関するものである。

【0002】

【従来の技術とその課題】電池は、エネルギー密度が高い方が優れている。しかし、エネルギー密度が高いと異常な環境下や誤使用された場合に電池が破裂・爆発しやすく非常に危険である。

【0003】従来の電池は、ゴム製の可逆弁やアルミラミネートフィルムを用いた破裂式の安全弁を用いていた。この場合、安全弁の口径が大きいほど作動圧が低くなり弁作動時の挙動が安全になる。しかし、口径を大きくすると、ゴム弁体やアルミラミネートの樹脂部を通して外部から水分が侵入したり、外部に電解液が逸散しやすくなり安全性の向上と引き換えに電池の長期信頼性が低下するという欠点がある。

【0004】そこで、このような欠点を改善するものとして、金属ケースにケースを貫通していない切れ込みを設けて破裂弁とし、内圧上昇時にはケースに裂け目が生じて圧力を開放するようにした電池が考案された。しかし、この電池は、金属の断裂を利用しているので破裂弁の作動圧が高く、かつ作動圧のバラツキも大きいという問題があった。

【0005】

【課題を解決するための手段】本発明は、樹脂フィルムを積層して接着した金属板からなる電池ケースを用いた電池において、前記金属板に切れ込みを設け、かつ前記樹脂フィルムには該切れ込みが貫通しないようにしたことを特徴とする電池を用いて前記の課題を解決するものである。

【0006】

【作用】本発明の電池は、電池ケースが金属層と樹脂層との二重構造になっている。そして、通常使用時には金属層によって十分な機械的強度を保証し、異常時（電池内圧上昇時）には、金属層に設けた切れ込みにそって樹脂層が断裂して電池に開口部が生じて電池内圧が開放されるようになっている。

【0007】この切れ込みは、全ての部分が金属層を貫通するように設けても良いし、切れ込みの一部だけ金属層を貫通するように設けてもよい。しかし、電池の密閉を保つために切れ込みは、樹脂層を貫通してはならない。本発明の電池は、樹脂の断裂を利用して安全弁を作

動させるので、従来の金属板の断裂を利用した安全弁に比較して作動圧が低くそのバラツキも少ない。

【0008】また、前記樹脂層は、線状に設けた切れ込みの部分のみ外気にさらされているので、従来のゴム弁やアルミラミネートフィルムを用いた破裂弁に比較して水分透過や電解液の逸散の問題が少ない。樹脂層を透湿性の低いポリプロピレンやポリエチレン、ポリエチレンテレフタレートなどによって構成すれば水分透過をより少なくできる。

【0009】

【実施例】以下に実施例を示す。

【0010】本発明のリチウム二次電池を次のように製作した。

【0011】電池ケースを次のように製作した。70 μ mのPPフィルム1を内面にラミネート接着し、外面に8 μ mの塗装膜を施した厚さ0.22mmの鋼板2をプレス成形して角形電池ケース本体3および電池ケース蓋4を製作した。このとき、ケース本体の底面に図1に示すような断面がV字形の切れ込み5を設けた。この切れ込みは、金属板を貫通しているが、樹脂層を貫通してはいない。図では、切れ込みの周辺部が盛り上がっているが、この様にするにより切れ込み先端への応力集中が起これやすくなり弁作動圧のバラツキがより少なくなる。

【0012】なお、電池ケースの製作の順序は、上記の順序以外でも良い。例えば、まず金属板に切れ込みをいれた後に樹脂フィルムを接着し、その後にプレス成形しても良いし、金属板に切れ込みをいれた後にプレス成形して、その後に樹脂フィルムを接着しても良い。

【0013】つぎに、正極板と負極板とからなる電池発電要素を前記電池ケースに格納し二重巻締め封口により電池を封口し本発明の角形リチウム二次電池（A）を製作した。

【0014】本発明の電池（A）は、上記実施例の角形以外に図2に示すような円筒形でもよい。そして、切れ込みの位置は電池の底面には限られない。また、切れ込みの全てが金属板を貫通していなくてもよく、一部だけが貫通していてもよい。

【0015】図3のように水分侵入を抑制するために金属箔6を接着層7を用いて切れ込み部に張り付けてもよい。

【0016】つぎに、電池ケースに金属層を貫通していない切れ込みを設けた以外は本発明の電池（A）と同様の、比較の電池（B）を製作した。

【0017】上記の2種類の電池をそれぞれ20個製作し、過充電して安全弁作動時の内圧を調べた。内圧の測定は、電池ケースに2mmの丸穴を設けて圧力計を接続して行った。その結果、本発明の電池の作動圧が $7 \pm 0.5 \text{ Kg/cm}^2$ であるのに対して、比較の電池は $18 \pm 5 \text{ Kg/cm}^2$ と弁作動圧が高くバラツキも大きかった。

【0018】また、比較のための電池は、弁作動時に大

音響がして内容物が飛散するなど危険であったが、本発明の電池は、弁作動時の音が小さく内容物の飛散もなく大変安全であった。比較のための電池の切れ込みをより深くして弁作動圧力を7～10kg/cm²程度低下させることを試みたが、切れ込み先端部に亀裂が生じて液もれ等がおこり易く、うまくいかなかった。

【0019】なお、実施例では電池缶の1箇所切れ込み部を設けたが、複数箇所切れ込み部を設けてもよい。また、電池の種類もリチウム二次電池に限られず、ニッケル・カドミウム電池等の他の形式の電池にも適用可能である。

【0020】

【発明の効果】上記のように本発明の電池は、従来の電*

*池に比較して安全弁の作動圧を低くできるので弁作動時の挙動がより安全になり安全性が向上した。また、作動圧のバラツキが少なくなるので電池の信頼性が向上した。

【図面の簡単な説明】

【図1】本発明に係る電池ケース本体を示した図。

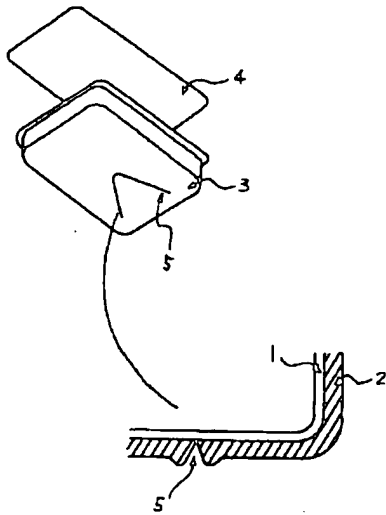
【図2】本発明の円筒形のリチウム電池を示した図。

【図3】金属箔を張り付けた切れ込みを示した図。

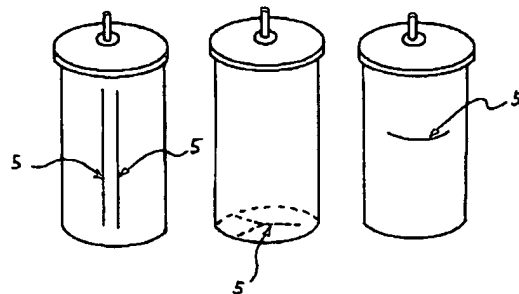
【符号の説明】

- | | |
|---|--------|
| 1 | 樹脂フィルム |
| 2 | 金属板 |
| 5 | 切れ込み |

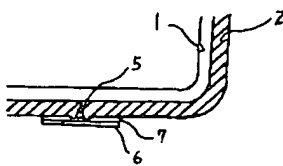
【図1】



【図2】



【図3】



【公報種別】特許法第17条の2の規定による補正の掲載
【部門区分】第7部門第1区分
【発行日】平成13年10月12日(2001.10.12)

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【公開日】平成7年8月11日(1995.8.11)
【年通号数】公開特許公報 7-2113
【出願番号】特願平 6-17028
【国際特許分類第7版】

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2/12 101

【F1】

H01M 2/02 A
F

2/12 101

【手続補正書】

【提出日】平成13年1月11日(2001.1.11)

【手続補正1】

【補正対象書類名】明細書

【補正対象項目名】特許請求の範囲

【補正方法】変更

【補正内容】

【特許請求の範囲】

【請求項1】樹脂フィルムを積層して接着した金属板からなる電池ケースを備えた電池において、
該電池ケースは切れ込み部を有し、
該切れ込み部は該電池ケースの金属板を貫通し、かつ該樹脂フィルムを貫通していないことを特徴とする電池。